

Daniels et al. (2000) examined the presence of threshold in PM10 concentration-response relationships for daily mortality using the largest 20 U.S. cities for 1987-1994. The results of their models suggest that the linear model was preferred over spline and threshold models. Thus, these results suggest that linear models without a threshold may well be appropriate for estimating the effects of PM10 on the types of mortality of main interest. Schwartz and Zanobetti (2000) investigated the presence of threshold by simulation and actual data analysis of 10 U.S. cities. In the analysis of real data from 10 cities, the combined concentration-response curve did not show evidence of a threshold in the PM10-mortality associations. Schwartz, Laden, and Zanobetti (2002) investigated thresholds by combining data on the PM2.5-mortality relationships for six cities and found an essentially linear relationship down to $2 \text{ : } \mu\text{g}/\text{m}^3$, which is at or below anthropogenic background in most areas. They also examined just traffic related particles and again found no evidence of a threshold. The Smith et al. (2000) study of associations between daily total mortality and PM2.5 and PM10-2.5 in Phoenix, AZ (during 1995-1997) also investigated the possibility of a threshold using a piecewise linear model and a cubic spline model. For both the piecewise linear and cubic spline models, the analysis suggested a threshold of around 20 to $25 \text{ : } \mu\text{g}/\text{m}^3$. However, the concentration-response curve for PM2.5 presented in this publication suggests more of a U- or V-shaped relationship than the usual “hockey stick” threshold relationship.

Based on the recent literature and advice from the SAB, our base assumption is that there are no thresholds for modeling health effects. Although not included in the primary analysis, the potential impact of a health effects threshold on avoided incidences of PM-related premature mortality will be explored as key sensitivity analysis, as noted above. Our assumptions regarding thresholds are supported by the National Research Council in its recent review of methods for estimating the public health benefits of air pollution regulations. In their review, the National Research Council concluded that there is no evidence for any departure from linearity in the observed range of exposure to PM10 or PM2.5, nor any indication of a threshold. They cite the weight of evidence available from both short and long term exposure models and the similar effects found in cities with low and high ambient concentrations of PM.

[continue on 6-23 – May 12 original]